

# CHROMOSOME NUMBERS IN *CYANELLA* (TECOPHILAEACEAE)<sup>1</sup>

ROBERT ORNDUFF<sup>2</sup>

## ABSTRACT

Chromosome numbers are reported for the four species of *Cyanella* that occur in South Africa. Seven collections of *C. hyacinthoides* had  $n = 12$ , five had  $n = 24$ , and one had  $n = 14$ . Two collections of *C. alba* had  $n = 12$ . One collection of *C. orchidiformis* had  $n = 12$ . Four collections of *C. lutea* had  $n = 12$ , two had  $n = 24$ , an unusual color variant had  $n = 8$ . Three other genera of the family are recorded as having  $n = 10$ ,  $n = 11$ ,  $n = 12$ , and  $n = 12$ , respectively. It is likely that  $x = 12$  for the family and that other numbers represent examples of aneuploid increase or reduction from this base number.

*Cyanella* is a small genus of six to eight species found in the Cape Province of South Africa and in adjacent South West Africa (Namibia). Placement of the genus has been a matter of some dispute, though current opinion puts it in the small family Tecophilaeaceae (sensu Airy Shaw, 1973) comprising six genera, each with one or a few species. Three of these genera—*Tecophilaea*, *Conanthera*, and *Zephyra*—are restricted to Chile, *Odontostomum* is endemic to California, and *Cyanastrum* occurs in tropical Africa. Chromosome counts have been reported for single species each of *Cyanastrum* ( $n = 11$ , Satô, 1942;  $n = 12$ , Nietsch, 1941), *Tecophilaea* ( $n = 12$ , LaCour, 1956), and *Odontostomum* ( $n = 10$ , Cave, 1949). No chromosome numbers have been reported for the remaining three genera. This paper presents a chromosomal survey of the four species of *Cyanella* that occur in South Africa; Mauve (pers. comm.) regards *C. pentheri* Zahlbr. as synonymous with *C. hyacinthoides* L.

## MATERIALS AND METHODS

During 1970–1971 living specimens of *Cyanella* were collected in the Cape Province and sent to the University of California Botanical Garden (Berkeley). When planted specimens flowered, anthers were removed, fixed, and squashed in aceto-carmin for examination of microsporogenesis.

## RESULTS

Twenty-three collections of four species were examined. Chromosome numbers of  $n = 8$ ,  $n = 12$ ,  $n = 14$ , and  $n = 24$  were obtained (Table 1).

<sup>1</sup>I am indebted to Mrs. A. A. (Obermeyer) Mauve for assistance with nomenclature; Dr. Peter Goldblatt for helpful comments on the manuscript; the staffs of the Compton Herbarium and the Bolus Herbarium for their hospitality during my stay in South Africa; the National Science Foundation, the Bache Fund of the National Academy of Sciences, and the C.S.I.R. (South Africa) for financial assistance; Mr. and Mrs. Neal McGregor of Glenlyon Farm for assistance in locating an unusual color variant of *C. hyacinthoides*; and Mrs. Patricia Watters for technical assistance.

<sup>2</sup>Department of Botany, University of California, Berkeley, California 94720.

TABLE 1. Chromosome numbers in *Cyanella*. Collection numbers are the author's. All localities are in the Cape Province, South Africa.

| Taxon   | Chromosome Number ( <i>n</i> ) | Locality                              |
|---|--------------------------------|---------------------------------------|
| <i>Cyanella alba</i> L.f.                         | 12                             | Bidouw Valley: 7424.                  |
| <i>Cyanella hyacinthoides</i> L.                  | 24                             | 3 mi N of Citrusdal: 7399.            |
|   | 24                             | Btw. Citrusdal and Clanwilliam: 7403. |
|   | 12                             | 4 mi W of Clanwilliam: 7412.          |
|   | 12                             | 1.5 mi W of Clanwilliam: 7416.        |
|   | 12                             | Doringbos: 7420.                      |
|   | 12                             | Near Doringbos: 7425.                 |
|   | 12                             | Bulshoek Dam: 7440.                   |
|   | 12                             | Klipkoppies, Nieuwoudtville: 7457.    |
|   | 12                             | Bidouw Valley: 7475.                  |
|   | 24                             | 1 mi W of Clanwilliam: 7481.          |
|   | 14                             | Bainskloof: 7501.                     |
|   | 24                             | Modderrivier, near Darling: 7526.     |
|   | 24                             | Kirstenbosch (native): 7632.          |
| <i>Cyanella lutea</i> L.f. var. <i>lutea</i>      | ca. 12                         | Worcester: 7355.                      |
|   | 24                             | Swartberg Pass: 7561.                 |
|   | 24                             | Swartberg Pass: 7565.                 |
|   | 12 <sup>a</sup>                | 11 mi E of Avontuur: 7598.            |
|   | 12                             | 24 mi W of Knysna: 7655.              |
|   | 8                              | Tygerberg: 7697.                      |
| <i>Cyanella lutea</i> L.f. var. <i>rosea</i> Bak. | 12                             | White's Farm, Grahamstown: 7658.      |
| <i>Cyanella orchidiformis</i> Jacq.               | 12                             | Nuwerus: 7187.                        |

<sup>a</sup> With laggards.

#### DISCUSSION

The most widely sampled species was *Cyanella hyacinthoides*, of which thirteen collections were examined. Seven of these had  $n = 12$ , including an unusual orange-flowered variant (7457) from the vicinity of Nieuwoudtville. One collection (7501) from Bainskloof had  $n = 14$ ; whether this number is typical for the population is uncertain. Five collections had  $n = 24$  and are probably tetraploid based on  $n = 12$ . There are no obvious morphological or distributional traits that separate the diploid and tetraploid races of *C. hyacinthoides*. Both occur very near each other in the vicinity of Clanwilliam. The two collections examined of *C. alba* L.f. both had  $n = 12$ ; these included a color variant (7463) that possessed tepals with dark maroon lower surfaces. The single collection of

*C. orchidiformis* Jacq. likewise had  $n = 12$ . *Cyanella lutea* L.f. is chromosomally as well as morphologically variable. Chromosome numbers of  $n = 8, 12,$  and  $24$  were obtained for *C. lutea* var. *lutea*. An unusual color variant from the Tygerberg (7697), with gold rather than lemon yellow flowers, had  $n = 8$ , the only known occurrence of this chromosome number in the genus. The single collection examined of *C. lutea* var. *rosea* had  $n = 12$ .

The relationships of *Cyanella* to other genera of the family are unclear. Hutchinson (1973) considered that "*Cyanastrum* is undoubtedly closely allied to *Cyanella*." Although  $n = 12$  (as well as  $n = 11$ ) has been reported for *Cyanastrum*, the two genera are very dissimilar morphologically and cannot be considered closely related. Sterling (1974) concluded that *Cyanella* is closely related to the African genus *Walleria* (and, by implication, to *Tecophilaea*), a genus referred to the Tecophilaeaceae by Hutchinson (1973, although he also has it listed in brackets in the Liliaceae-Dianelleae) but by Airy Shaw (1973) to the Liliaceae.

Thus, in the Tecophilaeaceae, chromosome numbers of  $n = 8, 10, 11, 12, 14,$  and  $24$  are known. The occurrence of  $n = 12$  in three genera suggests the possibility that  $x = 12$  is a common base number for the family, with  $n = 24$  representing a tetraploid chromosome number. The sequence  $n = 8, 10,$  and  $11$  thus may represent a decreasing aneuploid series and  $n = 14$  an example of aneuploid increase above the base number of  $12$ .

#### LITERATURE CITED

- AIRY SHAW, H. K. 1973. J. C. Willis. A Dictionary of the Flowering Plants and Ferns. Ed. 8. University Press, Cambridge.
- CAVE, M. S. 1949. Chromosome count of *Odontostomum hartwegii* Torr. In Documented chromosome numbers of plants. Madroño 10: 95.
- HUTCHINSON, J. 1973. The Families of Flowering Plants. Ed. 3. Clarendon Press, Oxford.
- LACOUR, L. F. 1956. Chromosome count of *Tecophilaea cyano-crocus*. In C. D. Darlington & A. P. Wylie, Chromosome Atlas of Flowering Plants. Macmillan, London.
- NIETSCH, H. 1941. Zur systematischen Stellung von *Cyanastrum*. Oesterr. Bot. Z. 90: 31-52.
- SATÔ, D. 1942. Karyotype alteration and phylogeny of Liliaceae and allied families. Jap. J. Bot. 12: 57-161.
- STERLING, C. 1974. Comparative morphology of the carpel in the Liliaceae: *Baeometra*, *Burchardia* and *Walleria*. Bot. J. Linn. Soc. 68: 115-125.